OSPF COMMANDS

AIM

The aim of the experiment is to implement the Open Shortest Path First (OSPF) commands.

APPARATUS REQUIRED

Cisco Packet Tracer

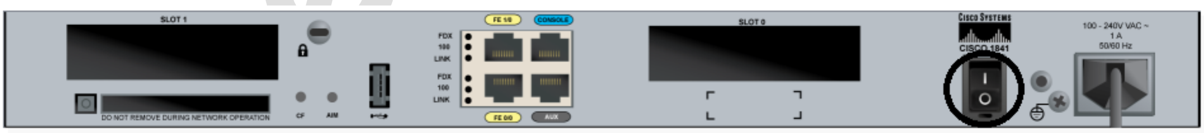
THEORY

Open Shortest Path First (OSPF) is a routing protocol for Internet Protocol (IP) networks. It uses a link state routing (LSR) algorithm and falls into the group of interior gateway protocols (IGPs), operating within a single autonomous system (AS). It is defined as OSPF Version 2 in RFC 2328 (1998) for IPv4. The updates for IPv6 are specified as OSPF Version 3 in RFC 5340 (2008). OSPF supports the Classless Inter-Domain Routing (CIDR) addressing model. OSPF is a widely used IGP in large enterprise networks. IS-IS, another LSR-based protocol, is more common in large service provider networks. OSPF detects changes in the topology, such as link failures, and converges on a new loop-free routing structure within seconds. It computes the shortest-path tree for each route using a method based on Dijkstra's algorithm. The OSPF routing policies for constructing a route table are governed by link metrics associated with each routing interface. Cost factors may be the distance of a router (round-trip time), data throughput of a link, or link availability and reliability, expressed as simple unitless numbers. This provides a dynamic process of traffic load balancing between routes of equal cost. An OSPF network may be structured, or subdivided, into routing areas to simplify administration and optimize traffic and resource utilization. Areas are identified by 32-bit numbers, expressed either simply in decimal, or often in the same dot-decimal notation used for IPv4 addresses. By convention, area 0 (zero), or 0.0.0.0, represents the core or backbone area of an OSPF network. While the identifications of other areas may be chosen at will; administrators often select the IP address of a main router in an area as the area identifier. Each additional area must have a connection to the OSPF backbone area. Such connections are maintained by an interconnecting router, known as an Area Border Rsouter (ABR). An ABR maintains separate link-state databases for each area it serves and maintains summarized routes for all areas in the network.

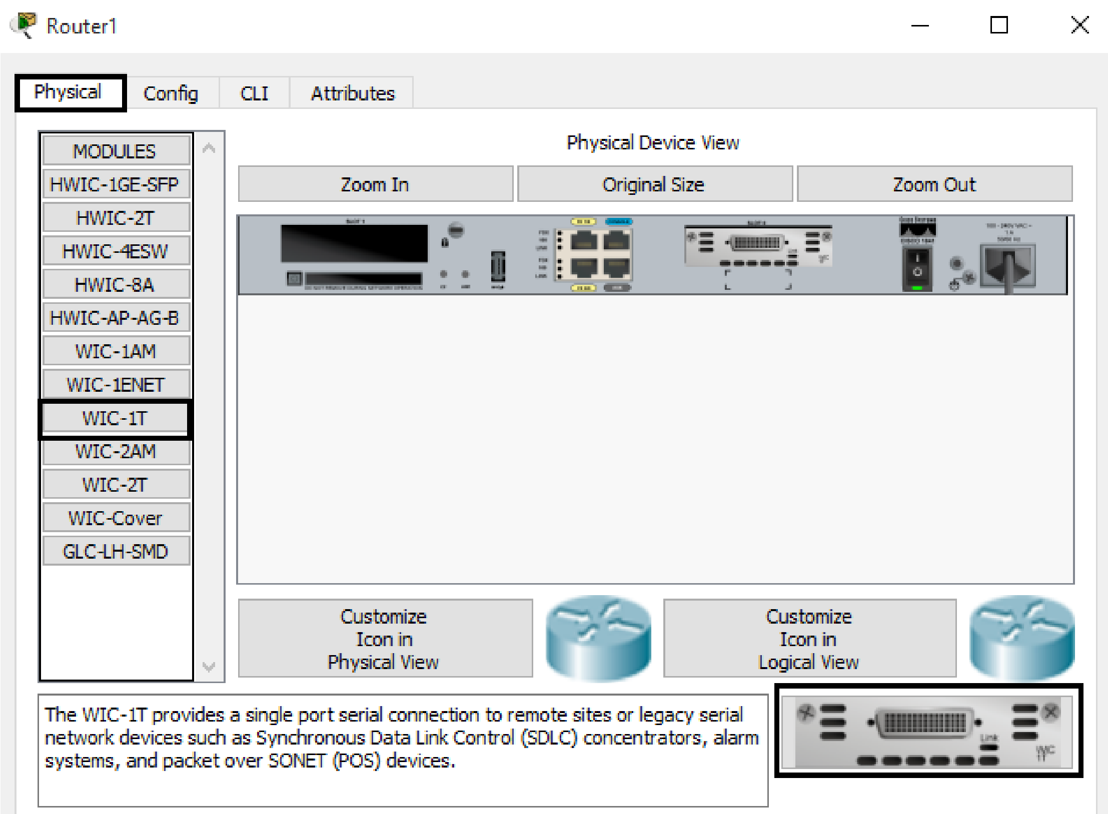
PROCEDURE

1. Press Ctrl+Alt+R to display the Routers panel and place the two 1841 routers: Router1 and Router2 as shown by dragging them from the panel and dropping them onto the window.

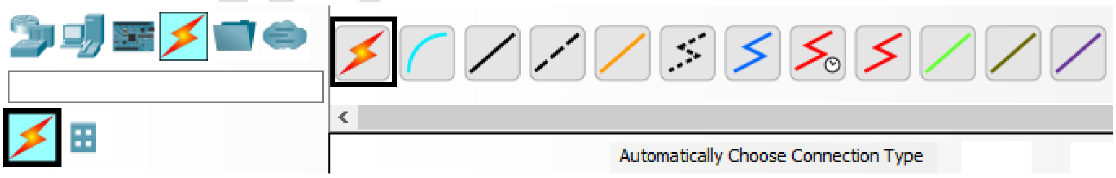
2. Click on the Router1. Under the Physical tab, scroll to the Physical Device View and switch off the Router by pressing once on the Rocker Switch shown.

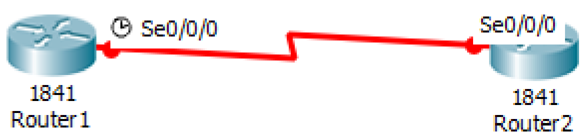


3. Under the Modules, click on the Wide Area Network (WAN) Interface Card (WIC-1T) from the list and drag and drop it onto the Router's Slot 0 as shown in the figure below and then switch the Router back on by pressing the Rocker Switch once.



4. Repeat the procedure in steps 2 and 3 for Router2 and add the WIC-1T module to its Slot 0.
5. Press Ctrl+Alt+O to display the connections panel. Select the "Automatically Choose Connection" icon and click on the Router1 then click on the Router2.





6. Click on the Router1 and select the CLI (Command Line Interface) tab and enter the following commands. Type "no" or "n" when asked if you would like to enter the initial configuration dialog and press Enter twice. For the OSPF we use a subnetwork mask for the given IP of 0.0.255.255 which is a (Wake on LAN (Local Area Network)) WOL

code mask. The two zeros at the front means that anything with 172.16 will be received and the remaining two bytes shall be ignored.

```
            --- System Configuration Dialog ---

    Would you like to enter the initial configuration dialog? [yes/
    no]: no
```

Router>enable

Router#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#hostname Router1

Router1(config)#interface Serial0/0/0

Router1(config-if)#ip address 172.16.20.1 255.255.0.0

Router1(config-if)#clock rate 64000

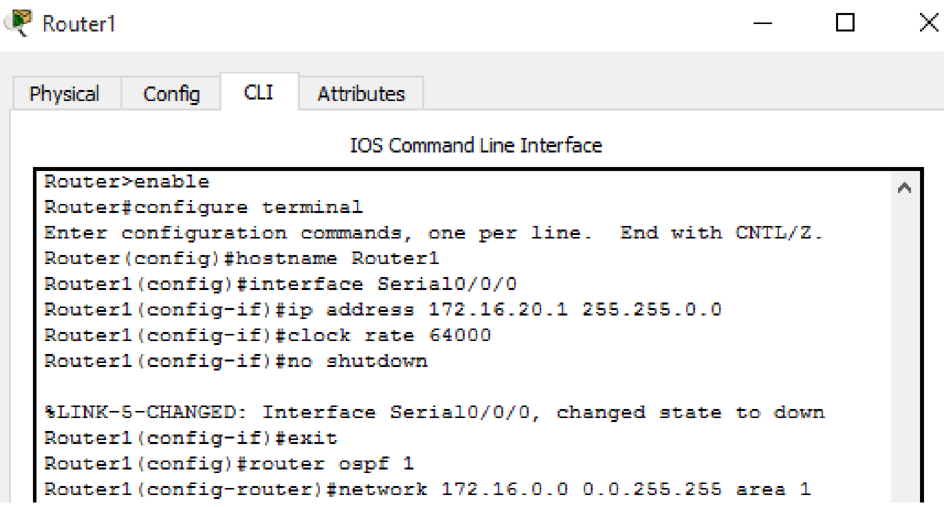
Router1(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down

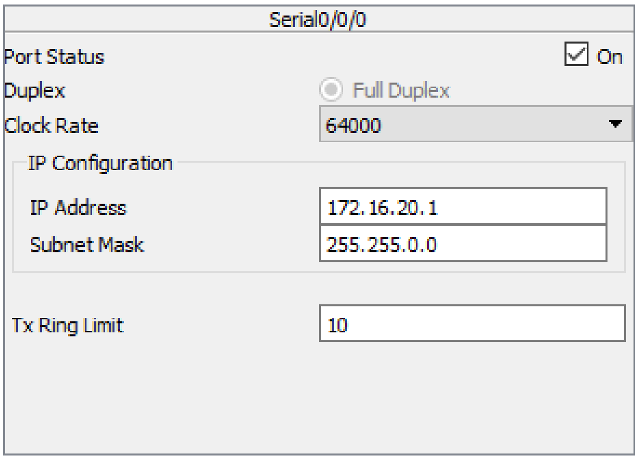
Router1(config-if)#exit

Router1(config)#router ospf 1

Router1(config-router)#network 172.16.0.0 0.0.255.255 area 1



7. Click on the Router1 and select the "Config" tab. Under the Serial 0/0/0 Interface tab, verify the configuration settings.



8. Click on the Router2 and select the CLI (Command Line Interface) tab and enter the commands as in the Router1.

Router>enable

Router#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#interface Serial0/0/0

Router(config-if)#ip address 172.16.20.2 255.255.0.0

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

Router(config-if)#exit

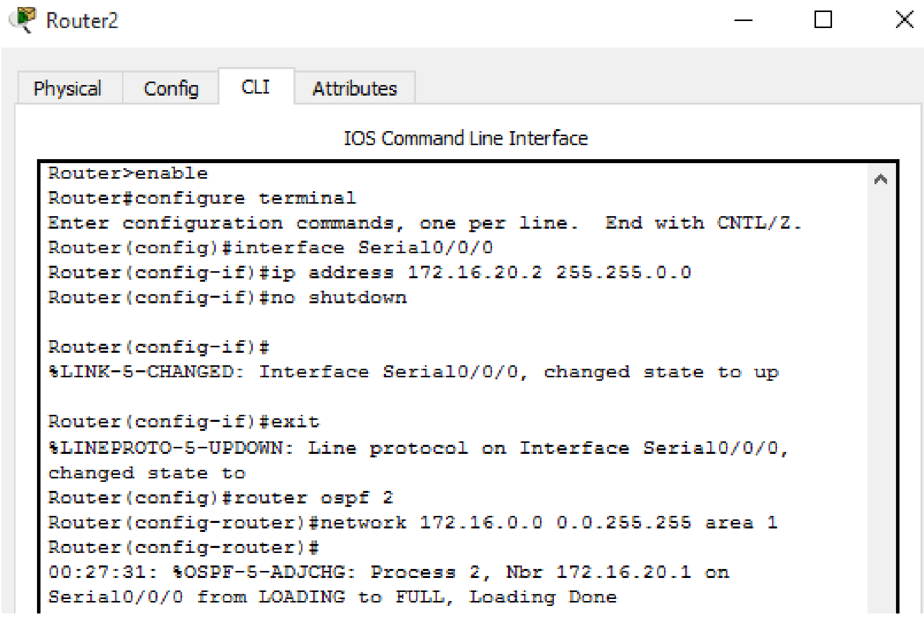
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to

Router(config)#router ospf 2

Router(config-router)#network 172.16.0.0 0.0.255.255 area 1

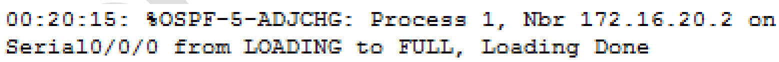
Router(config-router)#

00:27:31: %OSPF-5-ADJCHG: Process 2, Nbr 172.16.20.1 on Serial0/0/0 from LOADING to FULL, Loading Done

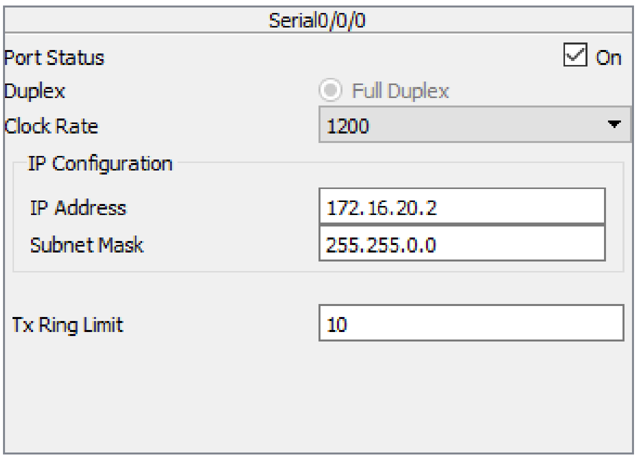


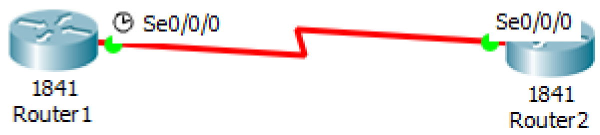
<u>Router1</u>

00:20:15: %OSPF-5-ADJCHG: Process 1, Nbr 172.16.20.2 on Serial0/0/0 from LOADING to FULL, Loading Done



9. Click on the Router2 and select the “Config” tab to verify the Router’s Serial Interface Settings as in step 7 for the Router1.

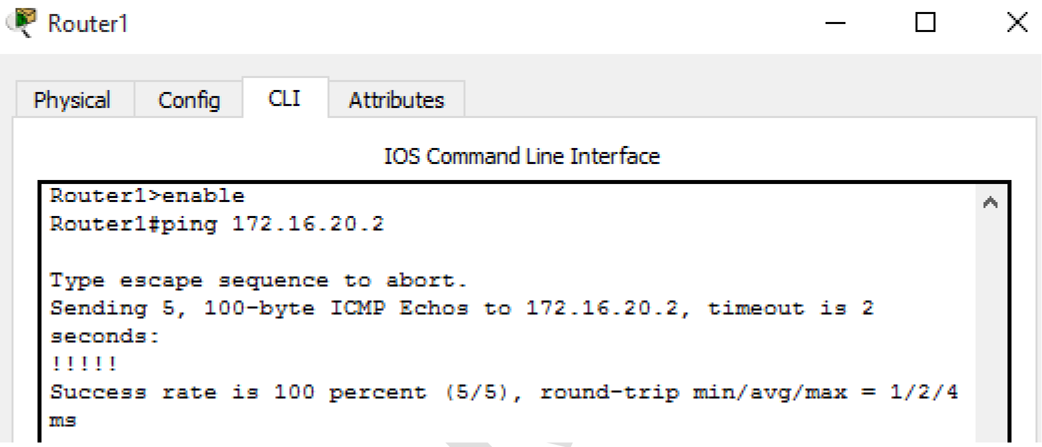




10. Test the connection by the ping command. Select the Router1 and ping it with the IP address of the Router2 (172.16.20.2).

    Router1>enable

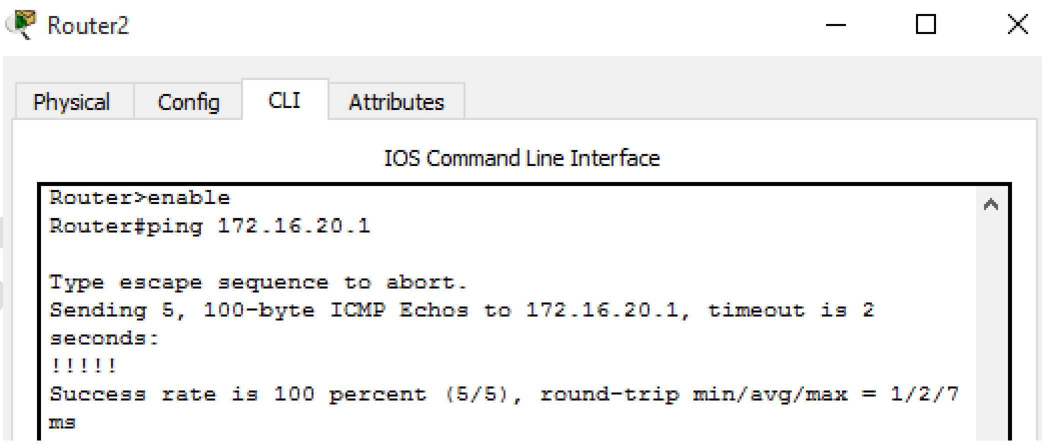
    Router1#ping 172.16.20.2



11. Select the Router2 and ping it with the IP address of the Router1 (172.16.20.1).

    Router>enable

    Router#ping 172.16.20.1



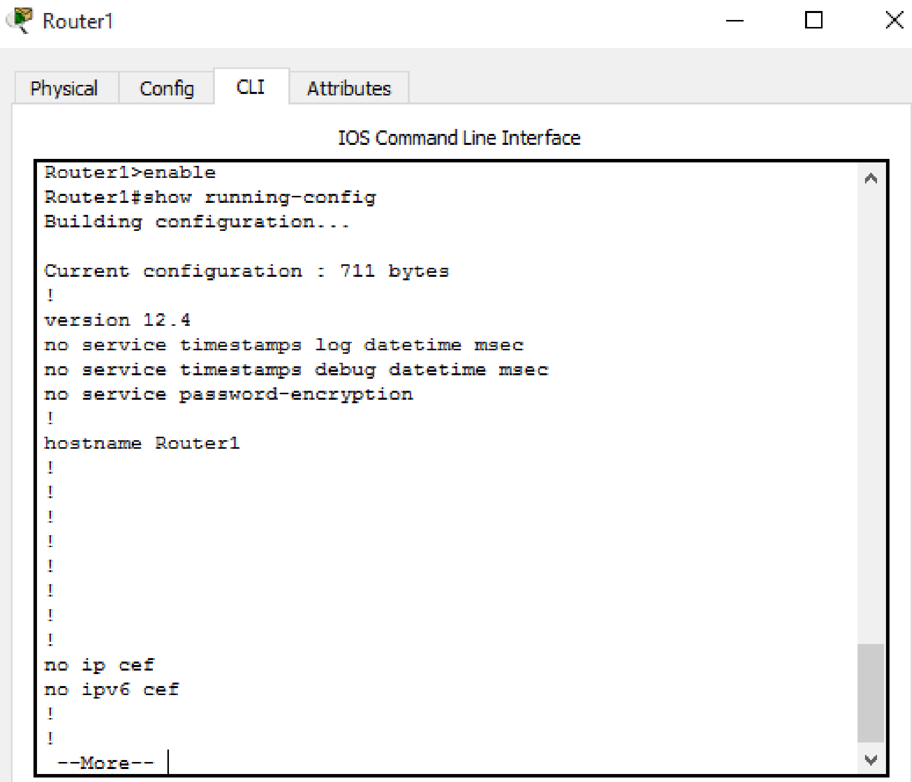
12. Check the Router's Configuration via the Command Line Interface.

    Router1>enable

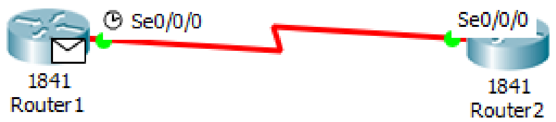
    Router1#show running-config

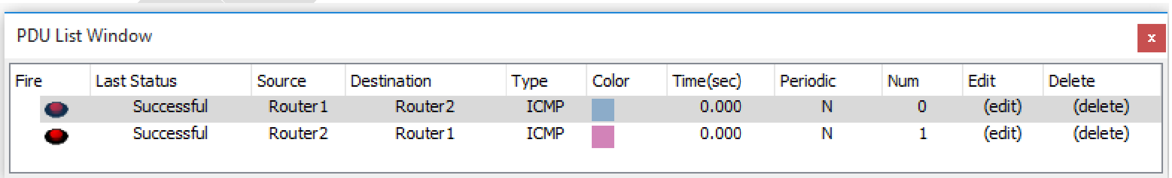
```
Building configuration...


Current configuration : 711 bytes
!
version 12.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router1
!
!
!
!
!
!
!
!
no ip cef
no ipv6 cef
!
!
 --More--
```



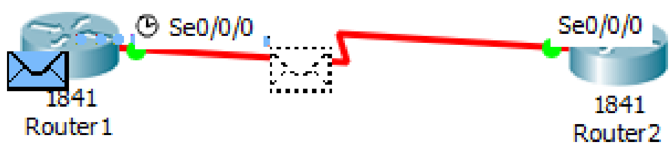
13. Send a Protocol Data Unit(PDU) from the Router1 to the Router2 and from the Router2 to the Router1 to test the connection by clicking on “Add Simple PDU” or pressing “P” then clicking on the first Router followed by clicking on the next Router. Press Ctrl+Shift+O to toggle the PDU list window and view the Fire Status.

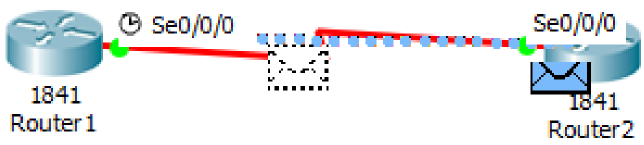


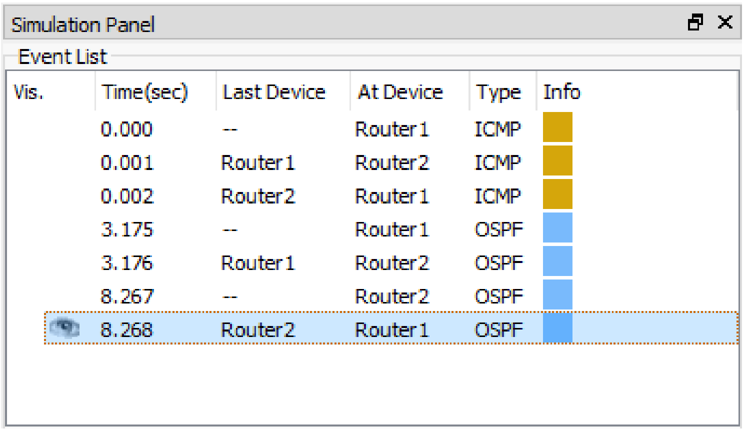

PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Router1	Router2	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Router2	Router1	ICMP		0.000	N	1	(edit)	(delete)

14. Press Ctrl+Shift+D to Delete the Scenario and all PDUs. Press Shift+S to enter into the Simulation Mode. Press “P” to Add a Simple PDU. Click on the Router1 then click on the Router2. Press Alt+C or on the Simulation Panel under the Play Controls click on the Capture/Forward button multiple times until you observe successful implementation of the OSPF under the Event List on the Type Column.



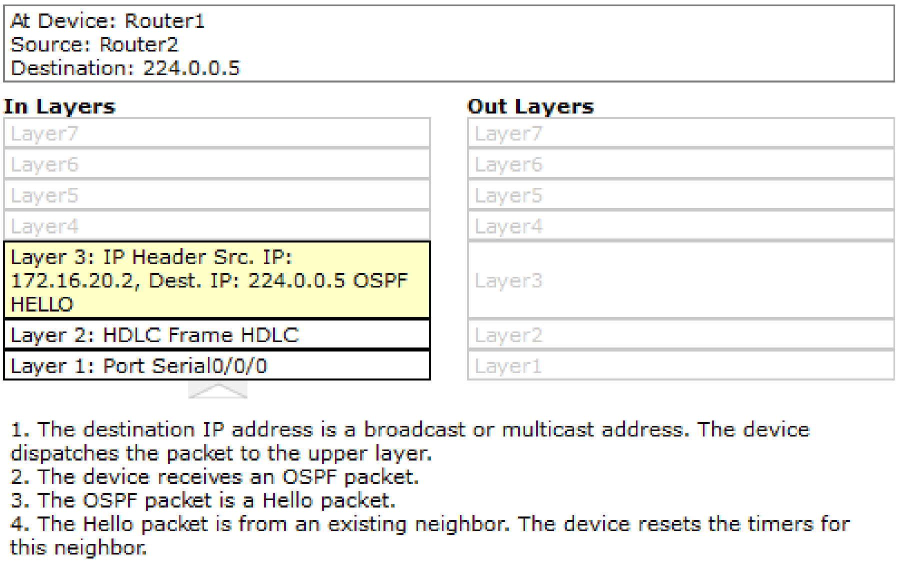



Simulation Panel

Event List

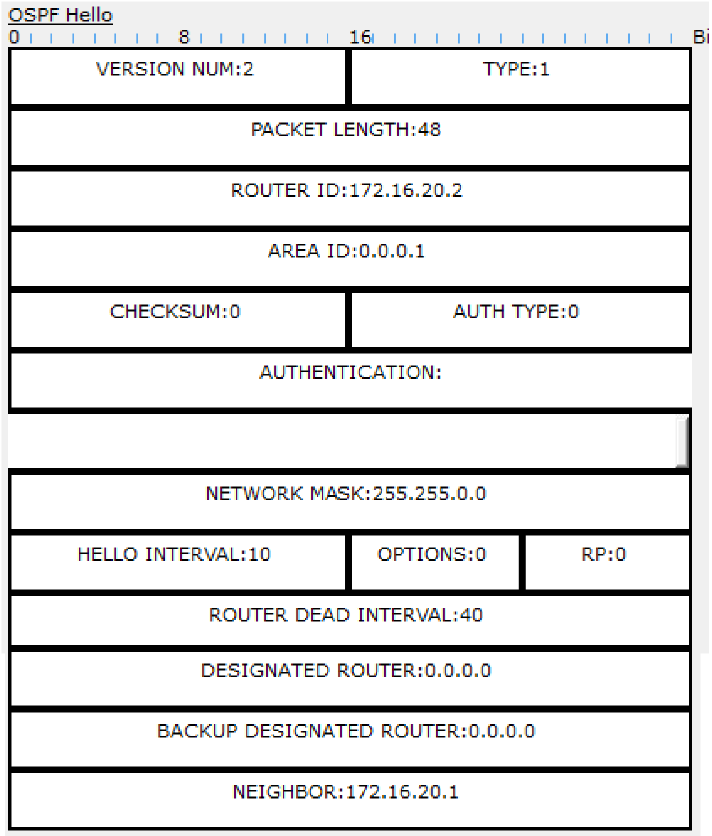
Vis.	Time(sec)	Last Device	At Device	Type	Info
	0.000	--	Router1	ICMP	
	0.001	Router1	Router2	ICMP	
	0.002	Router2	Router1	ICMP	
	3.175	--	Router1	OSPF	
	3.176	Router1	Router2	OSPF	
	8.267	--	Router2	OSPF	
	8.268	Router2	Router1	OSPF	

15. Observe the PDU Information at the Device by clicking on the OSPF event in the Event List. Under the OSI Model Tab view the “In Layers” model. Click on the Next Layer Button to observe the processes taking place at each layer of an event. Under the Inbound PDU Details tab you may observe the PDU Formats i.e. (High-Level Data Link Control) HDLC, IP, OSPF Hello.

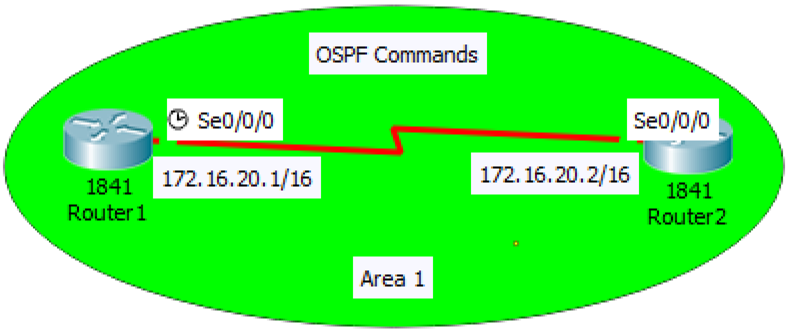

At Device: Router1
Source: Router2
Destination: 224.0.0.5

In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer4	Layer4
Layer 3: IP Header Src. IP: 172.16.20.2, Dest. IP: 224.0.0.5 OSPF HELLO	Layer3
Layer 2: HDLC Frame HDLC	Layer2
Layer 1: Port Serial0/0/0	Layer1

1. The destination IP address is a broadcast or multicast address. The device dispatches the packet to the upper layer.
2. The device receives an OSPF packet.
3. The OSPF packet is a Hello packet.
4. The Hello packet is from an existing neighbor. The device resets the timers for this neighbor.



SAMPLE OUTPUT



RESULT

Thus, the experiment to implement the Open Shortest Path First (OSPF) commands was executed successfully and the output is verified.